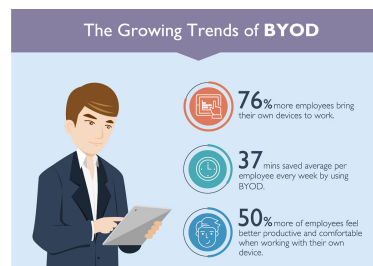# Graduate Operating Systems
(Embedded Systems & Scheduling)

Fall 2020

Paper "Cells"

- *What are differences between "classic" computers and smartphones?*
- Why virtualizing a mobile device?
  - BYOD Model
  - Development/testing
  - Parental control
  - Device sharing
  - Travel
  - …

The Growing Trends of **BYOD**

76% more employees bring their own devices to work.

37 mins saved average per employee every week by using BYOD.

50% more of employees feel better productive and comfortable when working with their own device.
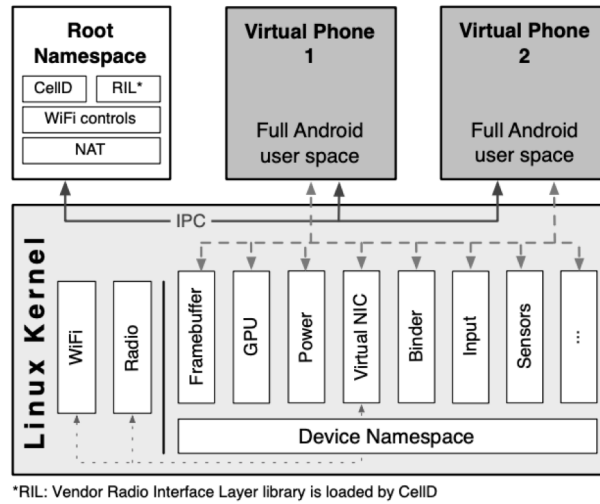
Paper "Cells"

- *Why not just use existing VM systems?*

- Foreground & background phones
  - Foreground: direct HW access
  - Background: shared HW access
- VoIP service (separate phone numbers)
- Access rights for components/sensors
  - No access
  - Shared access
  - Exclusive access

Paper "Cells"

- **Remapping** of OS resource identifiers
- Device **namespaces**
  - Wrapper
  - Event handlers
  - Modify drivers
- Root namespace
- Read-only base file system
- Scalability:
  - Base file system read-only; file system unioning
  - Linux Kernel Same-Page Merging (KSM)
  - Android low memory killer

Paper "Cells"

*RIL: Vendor Radio Interface Layer library is loaded by CellD

Paper "Cells"

- Security
  - User credentials
  - Device namespaces
  - Mount namespaces
  - CellID
- Graphics
  - Linux framebuffer
  - Mmap, ioctl
  - GPU virtualization

Paper "Cells"

- Power management
- Telephony
- Networking